Base Realignment and Closure (BRAC) Cleanup Team Workshop

Remedial Systems Optimization Quality Assurance

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Air Force Center for Environmental Excellance

Air Force Center for Environmental Excellence

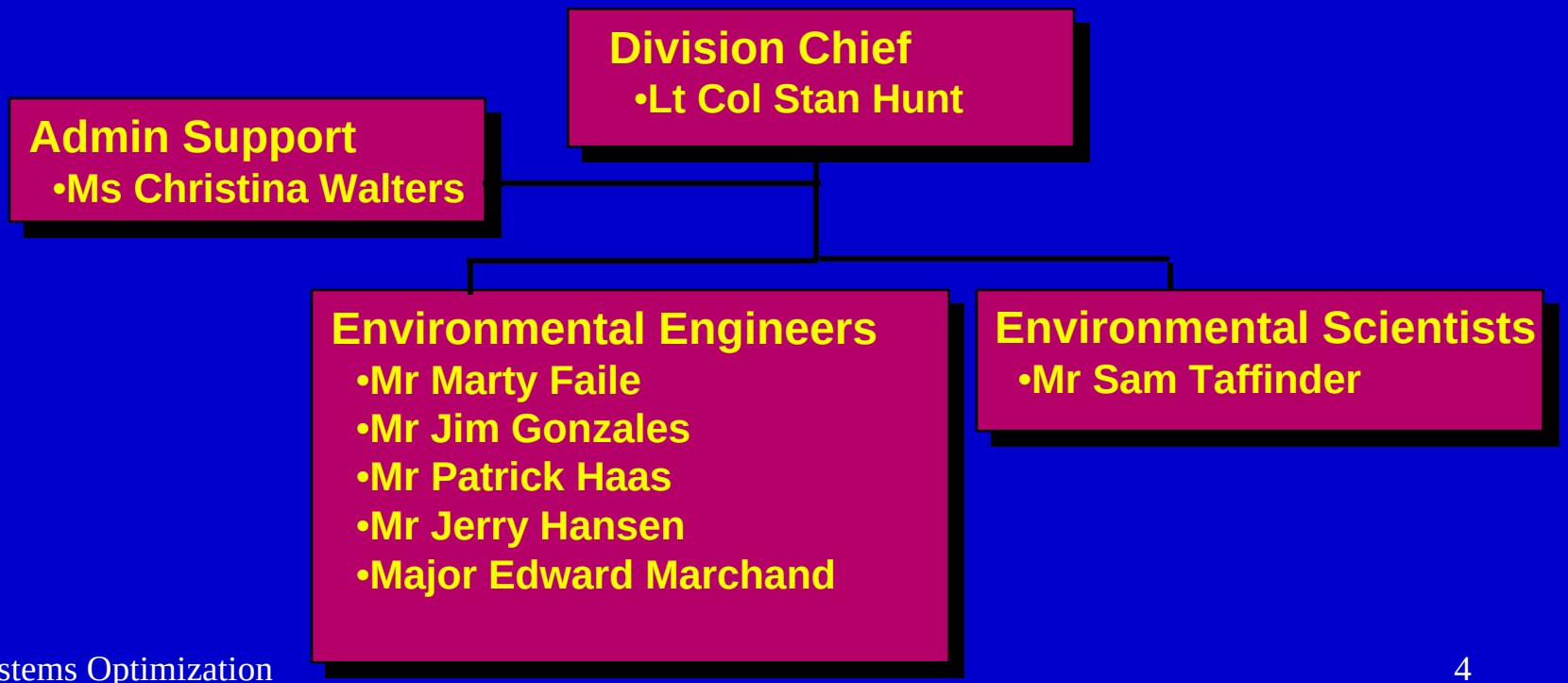
Remedial Systems Optimization Quality Assurance

Consultant Operations Division Mission

Provide expert technical consultation for environmental restoration programs world-wide.

Mission

- HQ AFCEE Technology Transfer Division is a field test unit for evaluating, demonstrating, and applying existing and innovative technologies to Air Force environmental problem areas including installation restoration and pollution prevention.



Presentation Outline

- **What is Remedial Systems Optimization (RSO)**
- **RSO Key Elements**
- **RSO Strategies and Conclusions**

What Is Remedial Systems Optimization (RSO)

- Systematic Iterative Process Designed to Ensure That Remedial Systems Meet Established Goals In the Most Cost Effective Manner to Assure Site Closure
- Process Based on Sound Engineering and Scientific Principles, Logic, and Sound Risk Management While Maintaining or Increasing the Project Quality

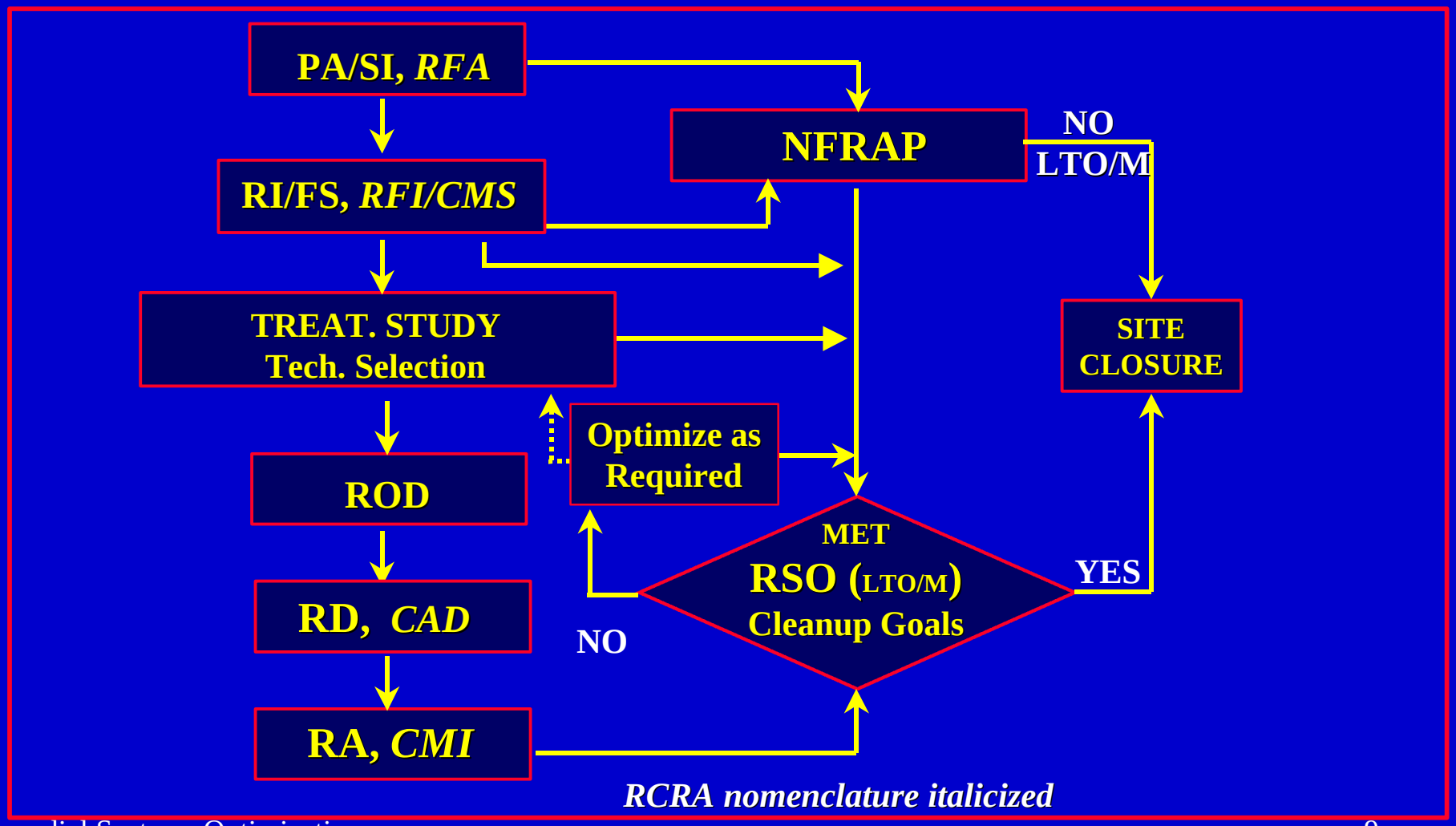
How Can RSO Help?

- **Being Done Now**
  - DQOs not always defined
  - ARARs drive Cleanup Goals
  - Remedial Design at Best Optimized by Trial and Error
  - Monitoring Parameters Defined By Analytical Method Selected
- **RSO Alternative**
  - Identify all DQOs Based on Data Use
  - ESSRA and ARARs Drive Cleanup Goals
  - Remedial Design Optimized Through Algorithms
  - Monitoring Parameters Are Only the Identified Contaminant Species

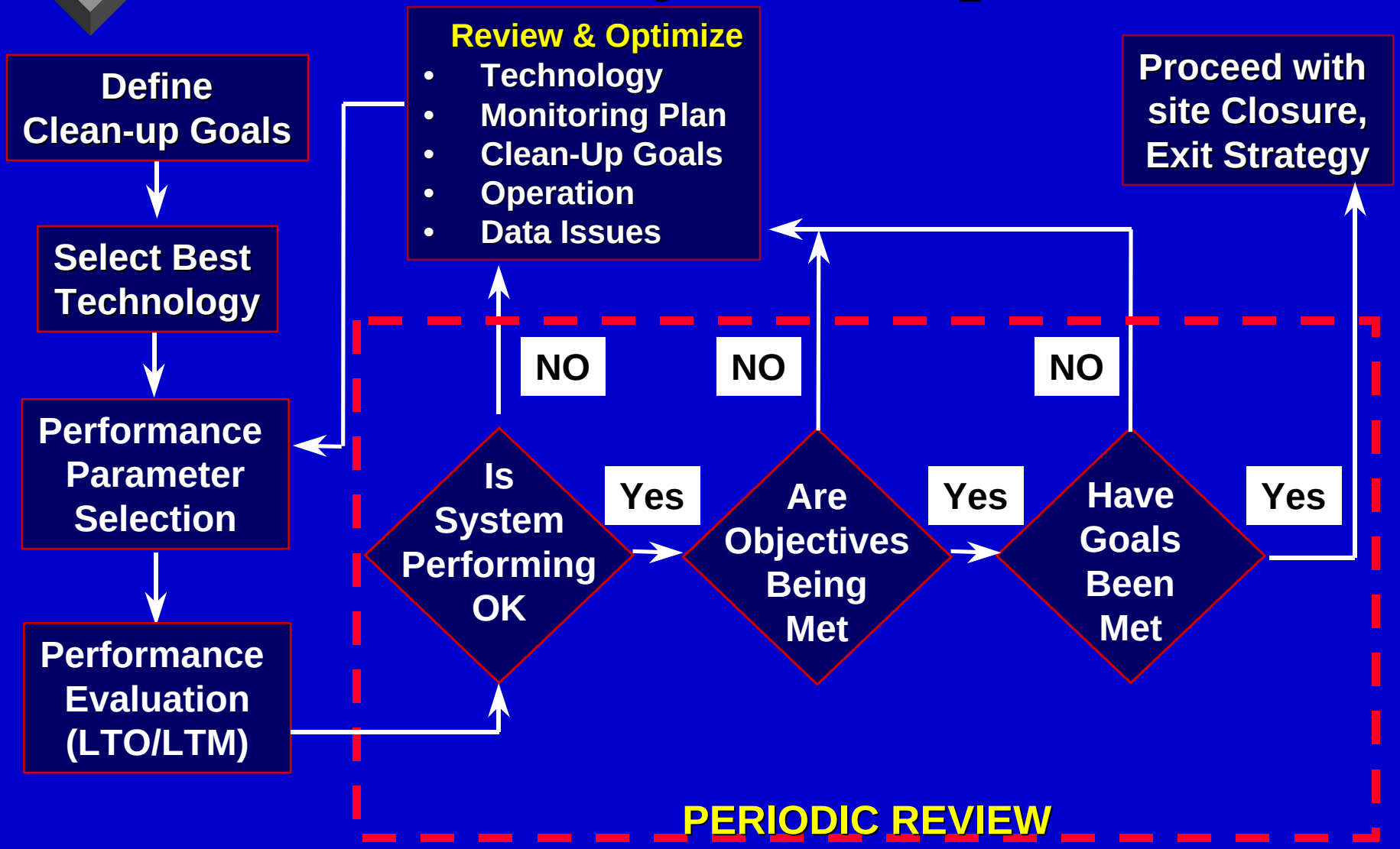
How Can RSO Help?

- **Being Done Frequently**
  - Continuing Technology Selection Decision Rules Not Identified
  - No Rules Established for LTO/LTM Sampling Locations and Frequency
  - Characterization Analytical Procedures Used for LTO/M
- **RSO Alternative**
  - Continuing Technology Selection Decision Rules Established
  - LTO/LTM Decision Rules Established for Sampling Location and Frequency
  - Select Analytical Procedures That Meet Monitoring DQOs

Restoration Process



Remedial Systems Optimization



Establish Cleanup Goals

- Establish Inorganics Background and/or Anthropogenic Organics Background
- Define Regulatory Requirements
- Calculate Preliminary Risk-Based Cleanup Goals
- Evaluate Practicability to Meet Cleanup Goals
- Establish Clean-up Goals with Regulator Concurrence

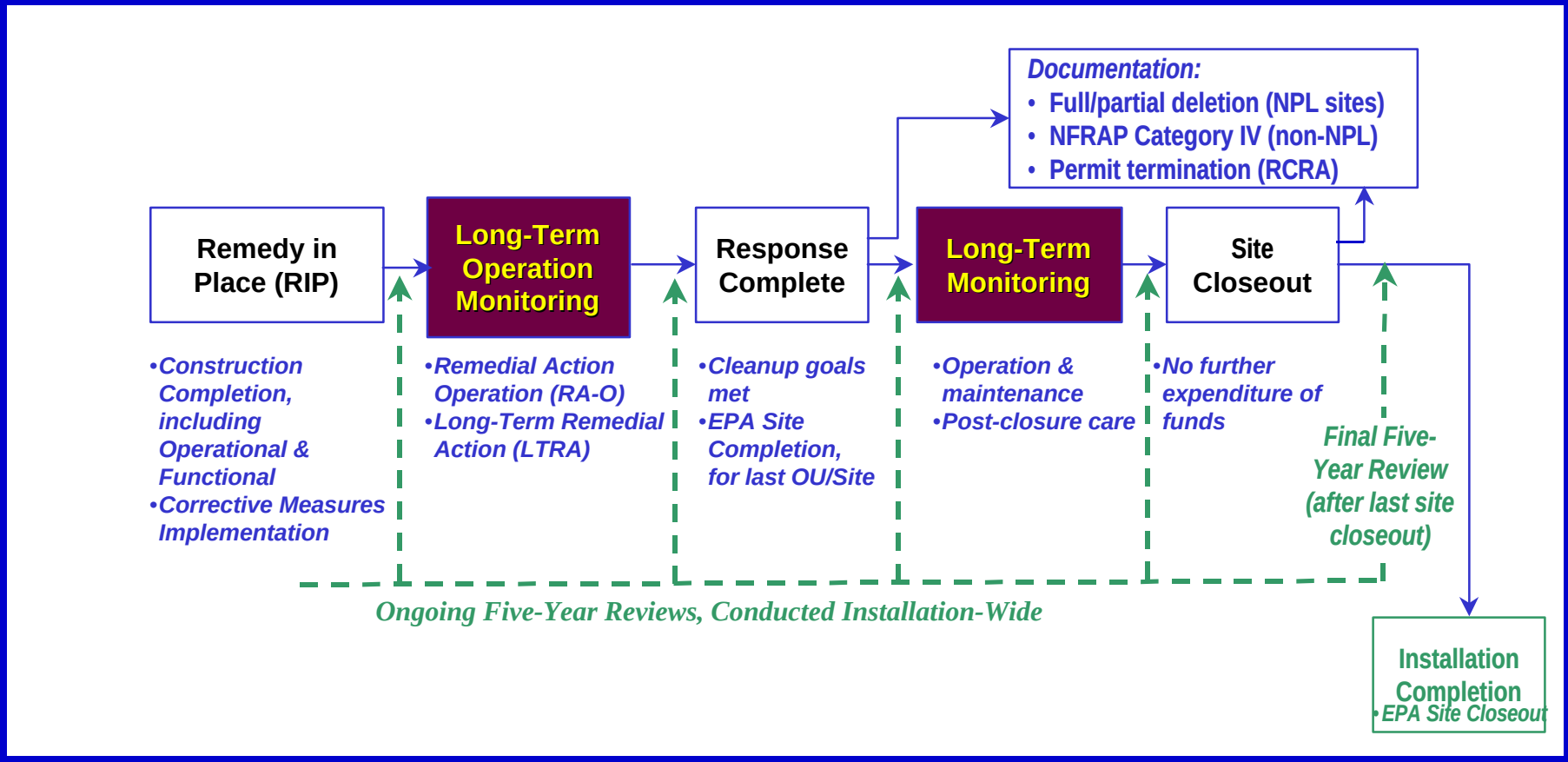
Technology Selection

- Conceptual Model Optimization
  - Saturated and/or Unsaturated Zone
  - Hydrogeologic Model
  - Injection / Extraction Well Location
  - Injection / Extraction Well Flow Rates
  - Contaminants Spatial Distribution
- Evaluation of Alternate and/or Innovative Technologies
- Design Optimum System for Technology Selected

Remediation Equipment Performance Optimization

- Selection of Performance Parameters
- Performance Assessment
- Unit Operation Optimization
- Feasibility to Meet Cleanup Goals

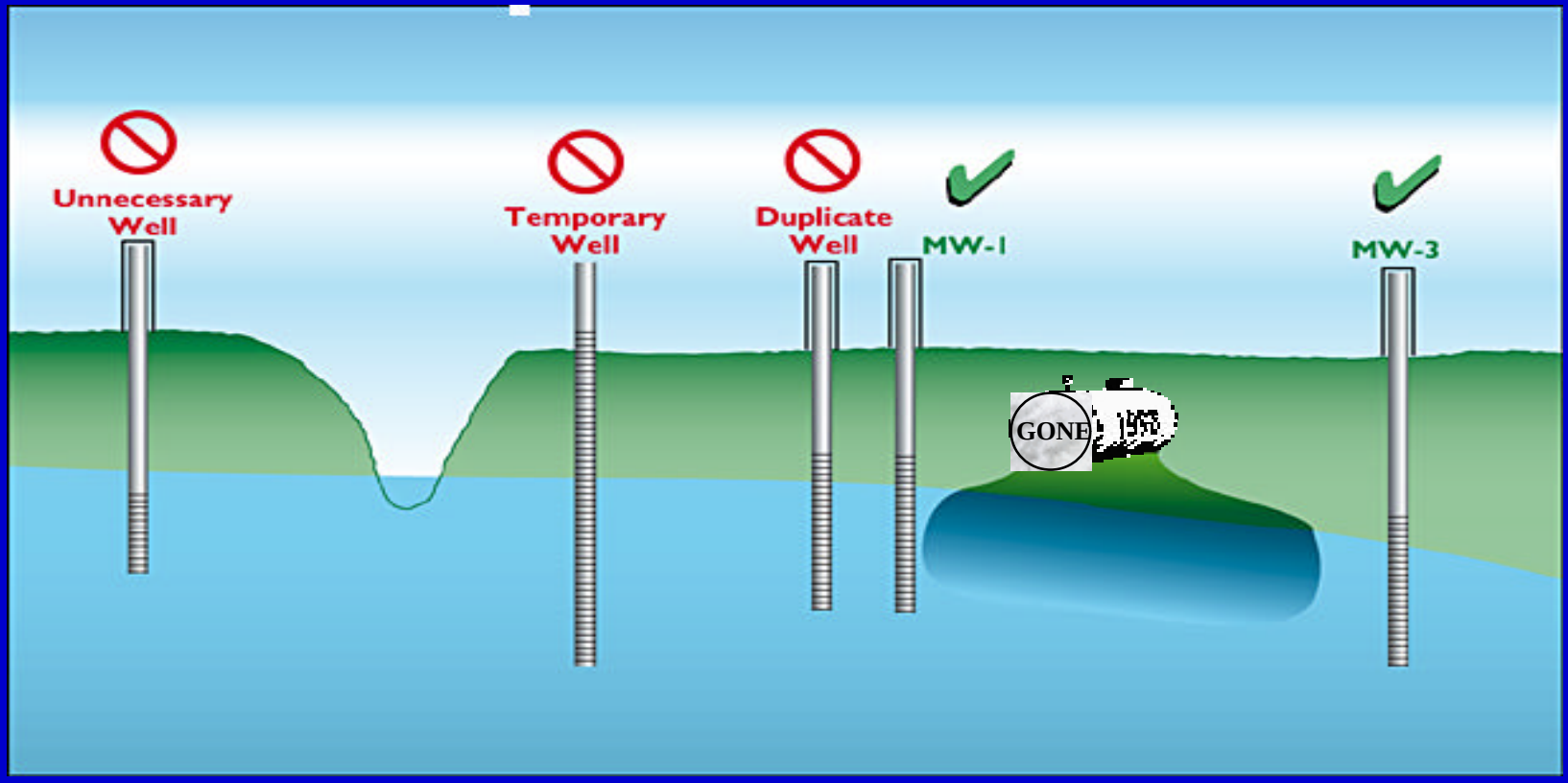
LTO/LTM on the Road to Site Closure



Long Term Operation (LTO) Remedial Action Operation Monitoring

- Effective Monitoring Locations
- Frequency of Sampling Events
- Effective Monitoring Parameters
- Appropriate Field Procedures
- Appropriate Analytical Procedures
- Assessment of Performance
- Approved Decision Tree

Effective Monitoring Locations

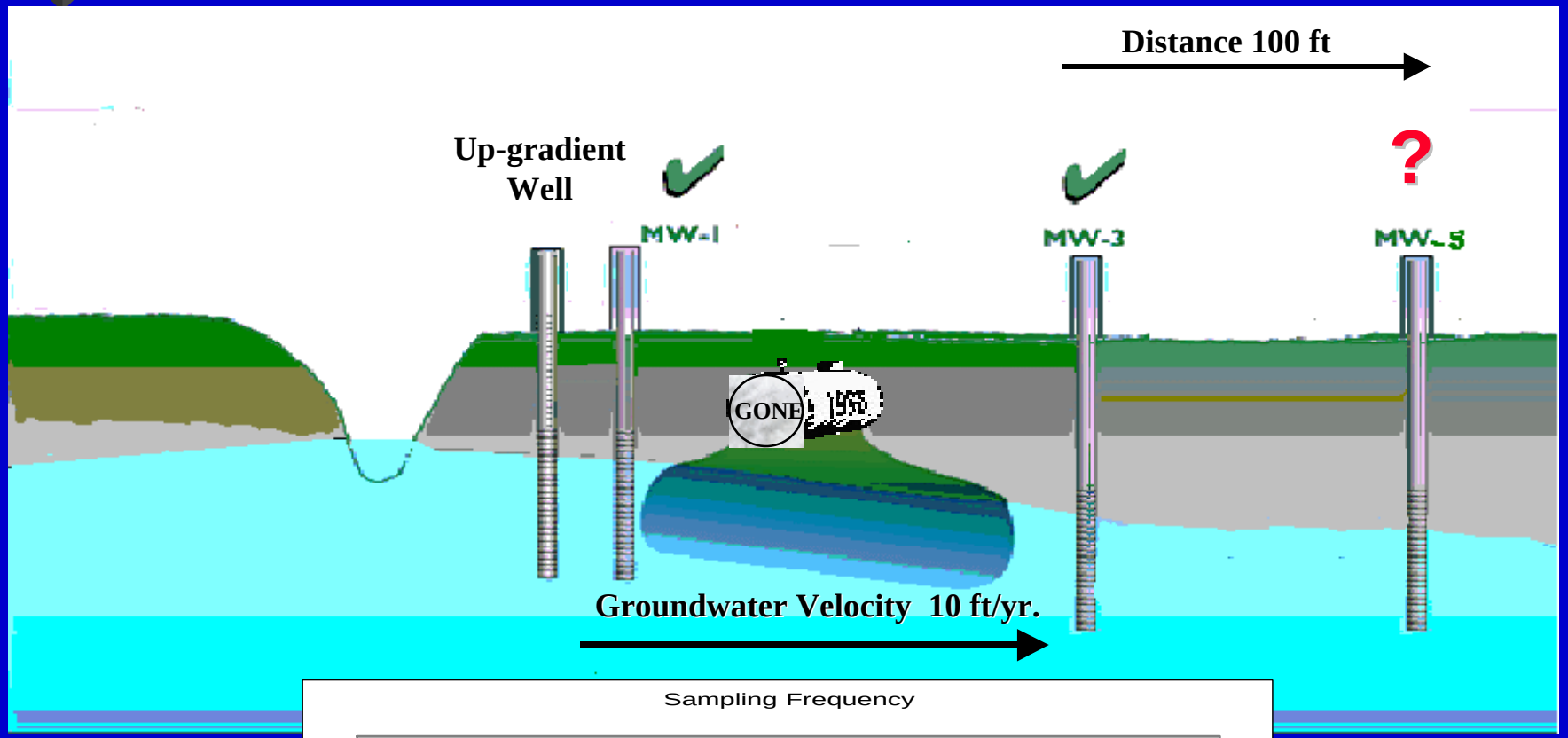


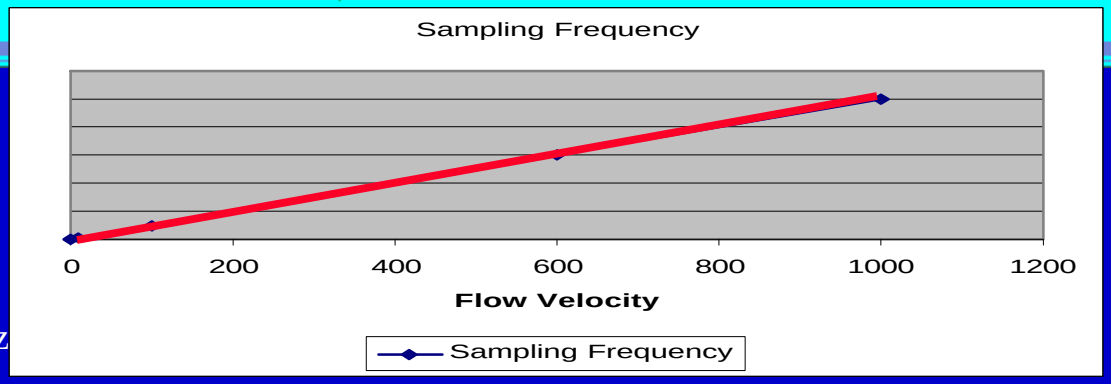
Eliminate duplicate or unnecessary sampling locations

Optimize Location and Number of Wells

- Geostatistics and Kriging Algorithm to Identify Areas of Uncertainty and Spatial Redundancy
- Strategic Monitoring Locations (Plume Dynamics)
  - Sentry Wells Between Contamination and Receptors
  - Upgradient
  - Downgradient Along Longitudinal Axis
  - Sidegradient/Cross Gradient
- Importance of Inorganic Background Levels

Frequency of Sampling





Optimize Sampling Frequency

- Frequency = *F* (Risk, Variability, Trend, Location, Plume Dynamics)
- Lawrence Livermore National Laboratory (LLNL) Algorithm
- Time Series Analysis
  - Trend Analysis Using Smoothing Techniques
  - Threshold Analysis (infringement on MCLs, ARARs, etc.)
- Plume Dynamics
  - Flow Direction & Velocity
  - Dispersivity, Diffusion, Decay, Dilution
- Risk Analysis
- Sampling Frequency Varies with Location and Treatment

Reduce Sampling Frequency

- Use a Sampling Reduction Decision Tree (DT) as Described in the AFCEE LTM Guide to Logically Reduce Sampling Frequency
- Base DT on Objectives of LTM Program, Historical Data, and Statistical Analysis (As Shown in the Following Wurtsmith AFB Example)

Example of Decision Tree

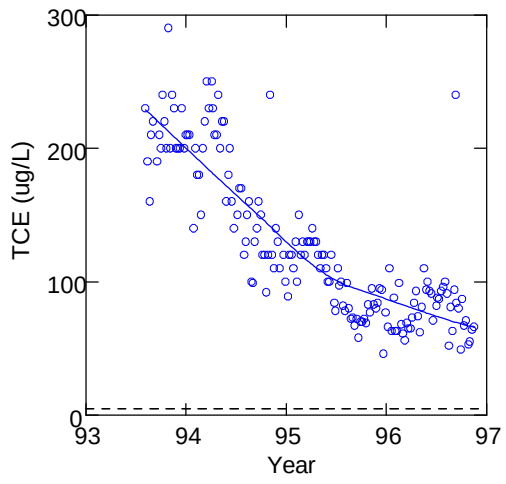
Smoothed Time Series Data

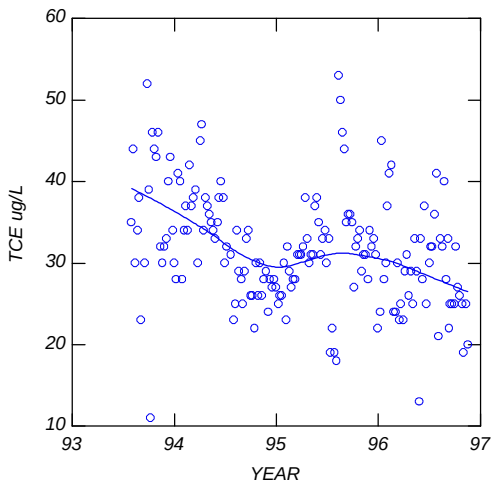
Influent Concentrations - Weekly Data

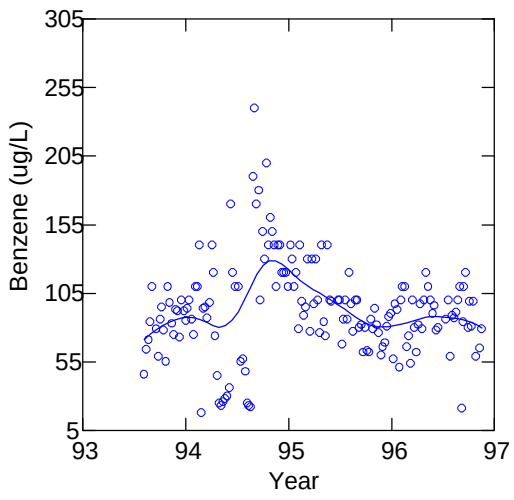
Pump & Treat Systems

Wurtsmith AFB

Mission Street | **Arrow Street** | **Benzene**



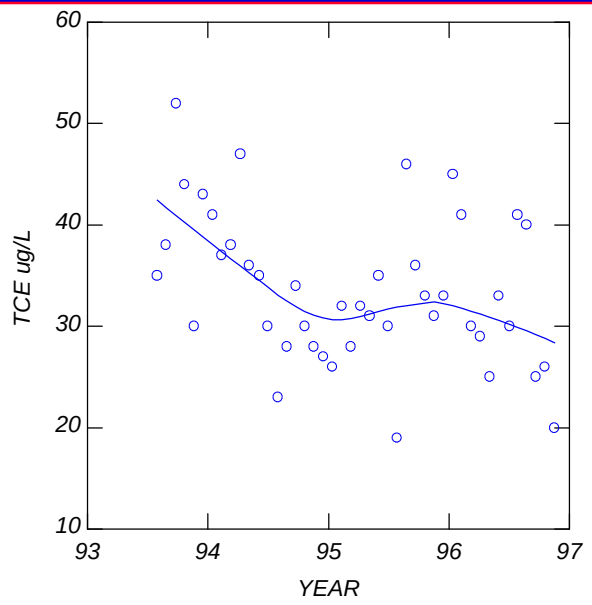




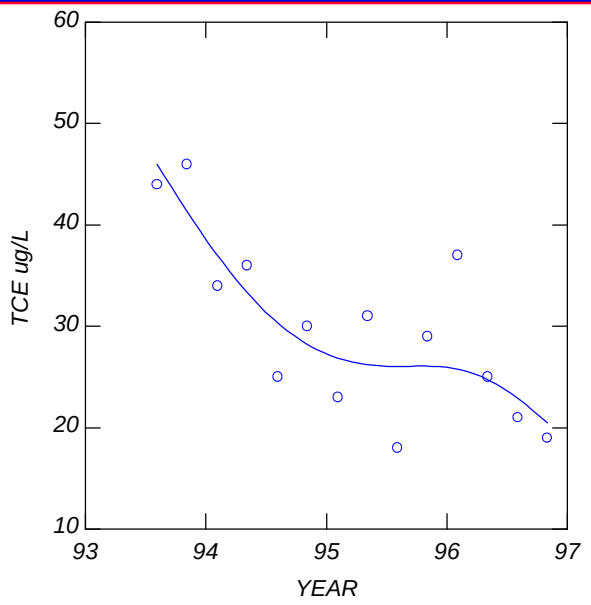
Reducing Sampling Frequency Without Significant Loss of Information

Arrow Street Influent TCE Data, Wurtsmith AFB

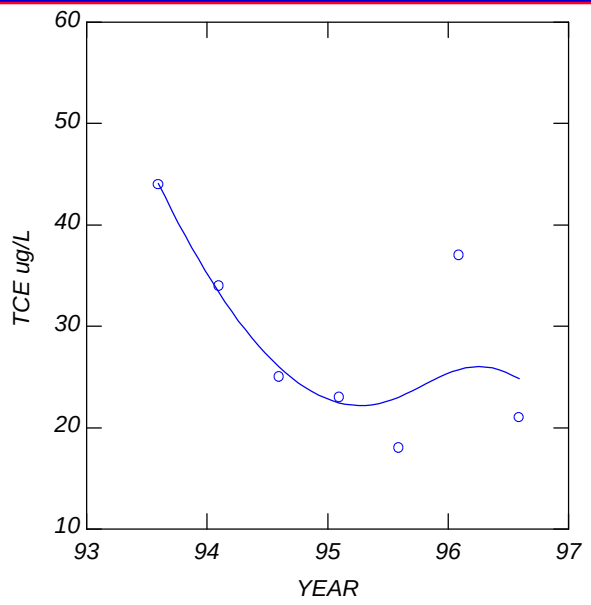
Monthly
77% Reduction



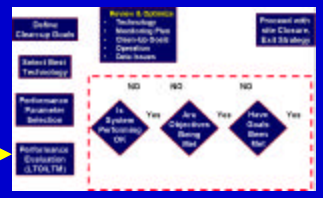
Quarterly
92% Reduction



Semiannual
96% Reduction

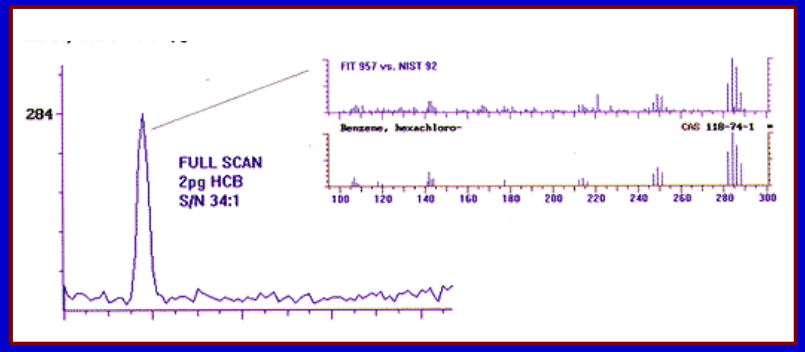


Selection of Effective Monitoring Parameters

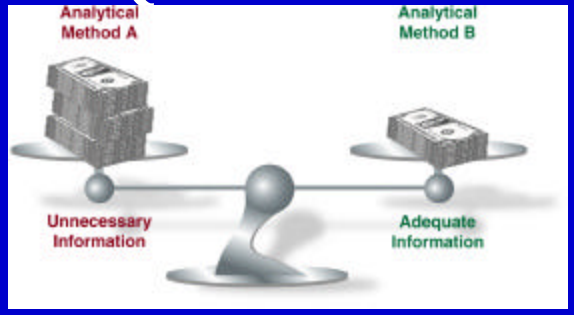


- Select Parameters that Cost Effectively and Efficiently Monitor Remedial Action Operation and Contaminant Transport (e.g. a JP-4 Plume Can Be Monitored By SW8310 - PAH, SW8020 - BTEX, SW8260 - VOC, O_2, Fe^{++}, NO_3, SO_4.
- Analytical Cost Range from $ 2 to $ 200

Simplify Analytical Protocols



- Positive "finger print" (GC/MS) Identification not Required when Monitoring Known Contaminants
- Monitor Only Contaminants Identified in Plume
- Use Least Expensive Procedure That Meets DQOs
- Evaluate Use of Field Kits with 10 - 20 % Confirmatory Analysis



Optimize Field Procedures

- Approved Field Sampling Plan
- Efficient Sampling Procedures (i.e. Low Flow Sampling and Purging Methods)
- Reduction of Sampling Generated Waste
- Efficient Analytical Field Screening Procedures (CO_2, O_2, etc.)

Long Term Monitoring (LTM)

Post - Remedial Action Complete

- Effective Monitoring Locations
- Frequency of Sampling Events
- Effective Monitoring Parameters
- Appropriate Field Procedures
- Appropriate Analytical Procedures
- Approved Decision Tree

Analytical Procedures

- Data Quality Objectives
- Data Sufficiency and Completeness
- Data Comparability
- Data Quality

Data Quality Objectives

- Identify Quantitative and Qualitative Intended Data Use
- Clearly Define the Study Objective
- Define Appropriate Types of Data Quality Required
- Specify Tolerable Limits on Decision Errors

Data Quality Objectives Process

- State Problem
- Identify Decision That Must be Reached
- Identify Inputs Required for Decision
- Identify Modeling Requirements
- Define Study Boundaries
- Develop a Decision Rule
- Optimize the Design

RSO Related Data Sufficiency and Completeness

- Excessive Redundant Data Wastes Funds and Ecological Resources
- Collect Only Sufficient Data to Reach Decision

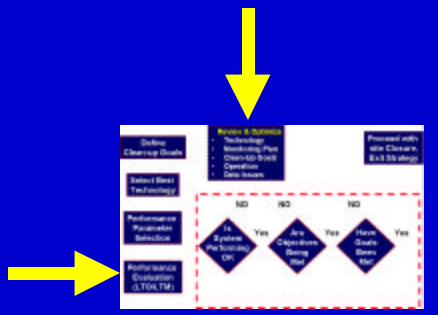
Data Comparability

- To Achieve Data Comparability in Alternate Method Use

  Evaluate:

  - Analytical Interferences
  - Detection and Reporting Limits
  - Recovery Control Limits
  - Sample Preparation

Data Quality



- Accuracy, Precision, Representativeness, Comparability, Completeness that Satisfy Project DQOs
- Quality Control Samples that Satisfy Project DQOs
- Identification, Sampling, and Analysis Only of Analytes of Concern

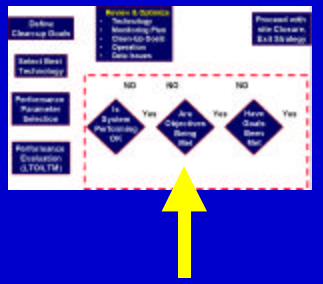
LTO/LTM - Summary

- AFCEE LTM Optimization Guidance Web-Page: http://www.afcee.brooks.af.mil/ER/ERFORM.HTM
- Statistical & Geostatistical Tools/Algorithms Exist
- Eliminate Unnecessary Sampling Locations
- Reduce Sampling Frequency to Achieve Data Sufficiency
- Before Capturing New Data, Evaluate:
  - What Benefit Is the New Data Generating?
  - Were Adequate Controls established?
  - Is there Concurrence on the Action Level?
  - What is the Likelihood that the Data Will Trigger Decision/Action?
- If It Is Not Recorded, It Was Never Cleaned. Maintain All Data in Electronic Format (AFI-32-7020)

Streamline Data Management and Storage

- Consistency in Approach of Program, Procedure, and Deliverables
- Contractual, Legal and Regulatory Reporting Requirements
- Standardization of Database Data Structure
- Data Collection Plan
- Data QC Assessment (Accuracy and Completeness)
- Data Storage and Life-span
- Data Transfer

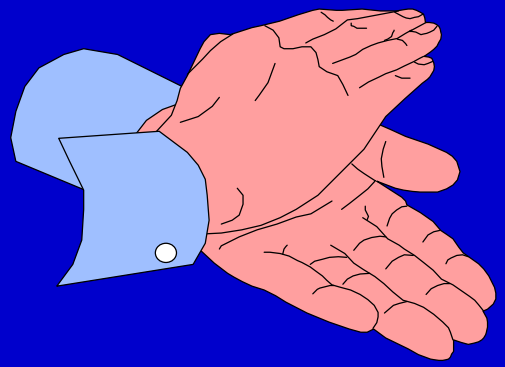
Periodic Review



- Create Check Lists To Monitor Technology Performance
- Create Performance Decision Rules
- Clearly Identify When Cleanup Actions Will be Modified or Stopped

Summary of RSO Strategies

1. Evaluate Cleanup Goals and Data Quality Objectives (DQOs)
2. Refine Remedial Design to Meet Cleanup Goals
3. Establish Decision Rules for Technology Selection and Performance Evaluation
4. Optimize Monitoring and Performance Procedures for Remediation Systems Per AFCEE LTM Guide
5. Verify That Field Procedures Meet DQOs
6. Verify That Analytical Protocols Meet DQOs
7. Streamline & Standardize Data Management



Thanks for listening!